

to either 1) reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the invention, or 2) enable one skilled in the art to which it pertains to make and/or use the invention. The Examiner indicates that the feature of the controller increasing duty cycle of the power circuit to cause the blade to enter a condition of aerodynamic stall is not clearly and concisely described in the specification.

Applicant respectfully traverses these rejections on the basis that a clear and concise description of this feature of the controller is given in the specification. The Examiner is directed to page 13, line 10 through page 15, line 9. This section of the specification describes how the controller's duty cycle can be controlled to induce aerodynamic stall in high wind conditions. This function of the controller is shown in Figure 9 as Region 4 of the controller's operating map. The function is further described in page 15, line 21 through page 16, line 2. This section of the specification refers to Figure 10 and the portion of the flowchart in which the wind turbine is in Region 4. In order to place the wind turbine blades in a condition of aerodynamic stall, the controller increases the duty cycle to 65%. The increase in duty cycle increases reaction torque on the rotor, as stated on page 11, lines 13-14 of the specification. Increasing the reaction torque slows the rotational speed of the wind turbine's rotor and blades, as described in the specification on page 13, lines 10-11. One of ordinary skill in the art would have understood, at the time of the invention, that slowing the wind turbine's rotor speed has the result of increasing the aerodynamic angle of attack on the blade and inducing aerodynamic stall. Therefore, applicant submits that this aspect of the invention is adequately described in the specification.

Claim 6 stands rejected under 35 U.S.C. 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the Examiner pointed out that "the duty cycle of said power circuit" lacked antecedent basis. Claim 6 has now been amended to correct this deficiency and applicant submits that this rejection has been overcome.

Claims 1-14 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Richardson et al in view of Hamelin et al. Applicant notes that the rejection states that Claims 1-16 are rejected, although claims 15 and 16 are drawn to a non-elected invention and should have been withdrawn from consideration by the Examiner. Applicant understands this rejection to apply only to claims 1-14.

The Examiner asserts that Richardson et al disclose a wind turbine with an alternator, an armature generating alternating current, a rectifier, and a power circuit controlling the voltage in the armature, a speed controller, and an inverter. The Examiner points out that Richardson et al do not disclose the power circuit selectively shorting the AC voltage from the armature. The Examiner relies upon the teachings of Hamelin et al to teach the technique of selectively shorting the AC voltage from the armature for the purpose of storing energy within the internal inductance of the armature during low speed rotation of the alternator rotor.

Claim 1 has been amended to require that the alternator is a permanent magnet alternator. Claim 10, as originally presented, required the use of a permanent magnet alternator. This is in contradistinction to the generator used in the Richardson et al wind turbine. The Richardson et al controller is applicable to large, utility-scale wind turbines whereas the present invention is applicable to small wind turbines that can either be used for off-grid battery charging applications or together with an inverter for distributed generation applications. Richardson et al show, on the far right-hand side of Figure 1, that their wind turbine is directly connected to the utility grid. They state in column 1, lines 20-23, and column 5, lines 12-13, that the generator is an AC induction generator. Utility-scale wind turbines that utilize AC induction generators and are grid connected operate under stable voltage conditions where the grid voltage is typically either 480 VAC or 600 VAC. The problem that the Richardson et al invention addresses is how to convert variable frequency output from the wind turbine to constant 60 Hz AC power that can be accepted by the utility grid. This problem is stated in the Richardson et al patent in Column 1, lines 49-62. The wind turbine disclosed by Richardson et al does not utilize a permanent magnet alternator and such an alternator would be inappropriate for use in a utility-scale wind turbine as disclosed by Richardson et al. Furthermore, the

circuitry and control system disclosed in Richardson et al could not be used with a permanent magnet alternator.

The device taught by Hamelin et al is a power supply circuit to be used with an alternator in an automobile to improve battery charging characteristics in low RPM idling conditions. This system is not compatible with the utility-scale wind turbine taught by Richardson et al and there is no motivation to combine the references. Hamelin et al disclose a device that improves output in low voltage conditions whereas the utility-scale wind turbine taught by Richardson et al operates at a constant utility grid voltage of either 480 VAC or 600 VAC. The output voltage of an induction generator does not vary appreciably and would not benefit from the voltage boost system described by Hamelin et al. Furthermore, there would be no reason to use an automotive type alternator in a utility-scale wind turbine. Therefore, applicant respectfully submits that the Examiner's combination of these two references is based on improper hindsight.

The Examiner notes that, regarding claim 6, that Richardson et al disclose in column 2, lines 63-68 and column 3, lines 1-8 the controller sensing the rotor speed and switching the rectifier to regulate the current in the alternator at the low speed mode of operation and controlling the alternator voltage at high speed mode of operation. The Examiner asserts that the condition of blade operating in aerodynamic stall will be inherent to the disclosed controller. Applicant respectfully disagrees with this statement. Richardson et al do not mention aerodynamic stall and, to the contrary, they specifically state in column 5, line 47 through column 6, line 2 that the wind turbine includes a pitch controller and that the pitch angle and torque are calculated together based on the measured rotor speed. This type of a wind turbine is clearly a pitch controlled turbine rather than a stall controlled turbine. The reaction torque on the rotor is used to minimize fatigue damage on the gearbox and low speed shaft while the pitch controller is used to maintain the desired rotor speed. This type of a control strategy is incompatible with a stall regulated wind turbine.

The amendment to claim 1, and the original language in claim 10, clearly defines that the wind turbine of the present invention uses a permanent magnet alternator. None of the other references of record discuss the use of a permanent magnet alternator in a

wind turbine with the control system claimed. Therefore, the invention as set forth in claims 1 and 10 is not taught by any of the references alone or in combination and the invention would not have been obvious to one of ordinary skill in the art. For this reason, applicant submits that claims 1-14 are non-obvious and are allowable.

For the foregoing reasons, applicant submits that the Wind Turbine Controller disclosed and claimed in the present application is not taught by any of the references of record, taken either alone or in combination. Therefore, allowance of the application is in order and is requested.

Respectfully Submitted,



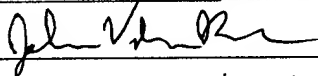
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on November 13, 2002

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